

スポーツ科学研究, 7, 141-144, 2010 年

The 3rd International Sport Science Symposium on “Sport Sciences for the Promotion of Active Life”  
【Project II Symposium】

Sport Sciences, 7, 141-144, 2010

Accepted for publication: 29 December 2010

## **Contribution of Cardiorespiratory Fitness and Peroxisome Proliferator Activated Receptor- $\gamma$ 2 Genotypes to the Metabolic Syndrome in Japanese Adults**

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**Objective:** Little information is available regarding the relationships among human obesity-related genes, cardiorespiratory fitness and metabolic syndrome (MetS). The present study was to investigate the contribution of cardiorespiratory fitness and peroxisome proliferator-activated receptor gamma 2 (PPAR $\gamma$ 2) genotypes to the MetS in Japanese men and women. **Research Methods and Procedures:** Sedentary and moderately active men (n = 211) and women (n = 505) aged 18–85 yrs participated in this study. We measured maximal oxygen uptake (VO<sub>2</sub>max) during an incremental cycle ergometer exercise test. Serum HDL-cholesterol, triglyceride and plasma glucose levels were measured in all subjects. The Z-score was derived by standardizing and

then summing the following continuously distributed indices of obesity (BMI), hypertension (SBP+DBP/2), fasting plasma glucose and serum triglyceride/HDL cholesterol to create a z-score. We analysed the PPAR $\gamma$ 2 genotypes (Pro12Ala and C1431T) using a real-time PCR with Taq-Man probe. **Results:** Significant correlations were observed between VO<sub>2</sub>max (kg/ml/min) and MetS score both in men (r=-0.319, P<0.0001) and women (r=-0.394, P<0.0001). Two-way ANOVA indicated that in middle-age and older group (age $\geq$ 40, n=414), MetS score in low fitness group was significantly higher than that in high fitness group (P<0.0001), but not associated with genotype effect. However, in younger group (age<40, n=302), MetS score in low fitness

group was significantly higher than that in high fitness group ( $P=0.0007$ ), and was significantly higher in the normal genotype group who has both ProPro and CC genotypes than that in the other genotype group who has either Pro12Ala (ProAla and AlaAla) or C1431T (CT and TT) genotype ( $P=0.0116$ ). In addition, the interaction between fitness and genotype in MetS score was

significant ( $P=0.0086$ ). Discussion: We concluded that poor cardiorespiratory fitness was associated with the risk of MetS in both men and women. When the younger subjects have both poor cardiorespiratory fitness and normal PPAR $\gamma$ 2 genotype, the effect of these factors accelerate on the risk of MetS.

### **Effective Exercise Programs among Frail Elderly: Establishing Community-based Long-Term Care Prevention Programs**

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In 2007, those aged 65 or older accounted for 22% of Japanese entire population, and Japan is now facing the advent of a “Super-aged” society earlier and more rapidly than any other countries in the world. Geriatric syndrome (e.g. falls, physical frailty, urinary incontinence, and dementia) and locomotive syndromes (e.g. low back pain, osteoarthritis, and osteoporosis) are well-known and highly prevalent ageing-specific functional and cognitive symptoms and high-risk condition for receiving the long-term care services among older adults. Considering the further continuing increase in the elderly population in Japan, developing the effective programs or strategies for preventing such geriatric and locomotive syndromes are urgently required for maintaining health and independence in elderly people and consequently

reducing the cost for medical care and long-term care in Japan. Over the past decades, many exercise interventions for older adults with the geriatric and locomotive syndromes have been developed. Several studies have validated that such interventions can achieve high rates of participation and improve their physical functioning and fitness such as muscle strength, walking and balance ability in the short-term. However, some additional considerations may need to develop the effective and feasible interventions in community practice settings. This presentation will identify such considerations through introducing our previous studies. These considerations are as follows:

- Many of exercise interventions are often entirely-focused on “improving physical functioning and fitness in one structured

setting during in its intervention period”. Thus, the older adults often fail to maintain the exercise or functional training after the intervention has ended. Including lifestyle approach in the intervention could provide a solution for it. An advantage of lifestyle approach is that people learn to integrate exercise and functional training into their daily lives.

- Most of these studies focused on physical functioning and fitness as outcomes in the short-term. However, it may be necessary to evaluate an impact of its intervention on their physical activity level on daily life, the economic effectiveness of its intervention

such as the certification of long-term care need when viewed from the perspective of a long-term care.

- In previous studies, evidence-based interventions have not been widely applied and tested in public health practice and other non-research setting. It is unclear whether evidence-based interventions produce similar outcomes and reach broad target populations when delivered in community practice settings. It would be necessary to understand and evaluate translational efforts of efficacious intervention to determine their public health impact.

### **Vasopressin V1a receptor polymorphism and adherence to long-term interval walking training in middle-aged and older people**

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It is well known that exercise training provides numerous health benefits to middle-aged and older people, reducing risks of lifestyle-related diseases (LSD). However, low adherence by trainees to the program has been a

major problem to be resolved. In this talk, we would like to show a single nucleotide polymorphism (SNP) decreasing the adherence and increasing the risks of LSD.

We recently reported that risk factors for LSD were higher in men with TT genotype of SNP (rs1042615) of the vasopressin V1a receptor in middle-aged and older people. Therefore, here, we assessed whether men with TT genotype had lower adherence to long-term interval walking training (IWT). Subjects ( $65 \pm 7$  (SD) yr) with CC, CT, and TT genotypes of rs1042615 (30, 88, and 49 men; 86, 189, and 104 women, respectively) performed IWT; 5 sets of 3-min fast walking at  $\geq 70\%$  peak aerobic capacity for walking ( $VO_{2peak}$ ) and 3-min slow walking at  $40\% VO_{2peak}/day$ ,  $\geq 4$  days/wk, for 29 mos. We found that dropout men showed significantly higher T allele frequency from the 11th mo of IWT compared with non-dropouts ( $P < 0.05$ ). Moreover, in men who had accomplished 29-mo IWT, although energy expenditure during fast walking/wk ( $EE_{fast}$ ) was not significantly different between groups until the 17th mo of IWT, it decreased thereafter in the TT group

( $P < 0.001$ ) whereas it remained unchanged until the 29th mo in other groups ( $P > 0.33$ ), resulting in 38% lower  $EE_{fast}$  in the TT group than other groups from the 18th to 29th on average ( $P < 0.001$ ). This lower  $EE_{fast}$  in the TT group than other groups was attributed to 24% lower walking days ( $P < 0.001$ ) and 25% lower energy expenditure during fast walking/walking day ( $P < 0.005$ ). Depressive and orthopedic symptoms were not different between groups throughout IWT ( $P > 0.19$ ). On the other hand, for women, these parameters were all similar between groups. Thus, middle-aged and older men (but not women) with TT genotype of SNP rs1042615 of the V1a receptor had lower adherence to IWT. These findings might help to explain the higher LSD risk factors in men with TT genotype.

**Keywords:** exercise training, aging, genetics, vasopressin